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Featured

Article

29 September 2021 | Open Access

Stress-adaptive conductive network and low-segregated polymeric inorganic interphases enable durable room-temperature silicon-based solid-state batteries

Silicon electrodes promise higher energy solid-state batteries but suffer from expansion and unstable interfaces. Here, the authors report a stress-adaptive conductive network and low-segregated polymeric inorganic interphases to address these issues.

Xiaoxia Cheng, Jianming Zheng, Pengfei Yu, Chongmin Wang

Article

29 September 2021 | Open Access

Ready to: Should we return to probability distributions to represent interfacial reactivity?

Annabel H. Squires, Eric Bergman de Lange, D. Alastair...

Article

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Cell-derived bacterial nanocarriers for bacterial dysbiosis and pulmonary remodeling

Bacterial nanocarriers have been used for the extracellular matrix functions. Authors here demonstrate that bacterial nanocarriers are typically proliferative, especially after a single-dose administration, and can be used for the treatment of pulmonary fibrosis. Mechanistically, they undergo in vivo crosslinking in response to lysine accessibility by cells, by coupling bacterial functions to host-derived matrix components, and thereby alter the mechanical properties of the extracellular matrix and pulmonary vascular dynamics, with important results remodelling during the fibrotic process.

Rocco A. Bruno, Scott L. Schneider, Ke Yang, Wei

Article

29 September 2021 | Open Access

Should we return to probability distributions to represent interfacial reactivity?

Linda I. Eriksson

Article

29 September 2021 | Open Access

In vitro reprogramming of glioma stem cells into dendritic cell-like cells for glioblastoma immunotherapy

Glioblastoma stem cells (GSCs) are key to the immunosuppressive microenvironment. Here, the authors develop a reprogramming strategy to convert GSCs into dendritic cell-like cells (GSC-DCs) that can activate T cells and induce glioblastoma stem cells (GSCs) type 1 conventional dendritic cell-like cells thereby presenting endogenous tumor antigens to induce potent anti-tumor immunity.

Yuanwei Zang, Zhiyu Li, Yu Jiang, Yuan...

Article

29 September 2021 | Open Access

Tail adhesions overcome cell surface steric interference and rescue antibody-dependent phagocytosis in macrophages

Antibody-dependent cellular phagocytosis (ADCP) is a key mechanism of action for therapeutic antibodies, but its efficacy is limited by poorly understood steric constraints. Here, the authors use single-molecule imaging to show that macrophages overcome these constraints by extending tail adhesions, which enable ADCP even when the antibody-antigen complex is buried deep within the glycocalyx.

Ayesha Chaudhry, Alexis M. Joffe & Daniel A. Fletcher

Article

29 September 2021 | Open Access

Manipulation of ferromagnetism with a light-driven nonlinear Lifshitz invariant

Lifshitz invariants are terms allowed in certain types of antiferroelectric, ferroelectric, or antiferromagnetic materials, which can lead to a variety of novel physical properties. Here, the authors report the first case of an optical Lifshitz invariant, identify it in the van der Waals antiferromagnet $MnPS_3$, and demonstrate its use for ultrafast magnetic control.

Thuc Mai Luu, Ke Chen, Dmitry A. Garanin, Eric Bourret-Courchesne, David G. Cahill & Jigang Wang

Article

29 September 2021 | Open Access

Enhancing cycling stability by preventing high-voltage phase-transition reversibility in high-nickel positive electrode materials

High-nickel positive electrodes suffer rapid degradation during high-voltage cycling. Here, authors show that preventing phase transition reversibility by suppressing oxygen release can enhance cycling stability.

Yuheng Zhu, Chih W. Liu & Xiao Hua

Article

29 September 2021 | Open Access

Efficient transport kinetics of indirect excitons in van der Waals heterostructures

Here, the authors investigate the transport kinetics of indirect excitons (IXs) in a MoSe2/WSe2 van der Waals heterostructure and observe a remarkably high IX mobility, consistent with IX superfluidity.

Hanan Dery, Jie Li, Arfianto Fadil, Ji Ho Sung, Jeongyong Kim, Heejun Yang, Chul-Ho Lee, Gwan-Hyoung Lee, Paul Kim, Hui Deng & Xiaodong Xu

Article

29 September 2021 | Open Access

Branched cryo-nanosheet junction fluorofluidic gels for interface adaptive thermal conduction and mechanical resistance

Conventional thermal interface materials often suffer from a certain degree of mismatch between their thermal conductivity and mechanical resistance. Here the authors report a branched cryo-nanosheet junction fluorofluidic gel with ultra-low thermal resistance and high mechanical resistance.

Wenhong Tang, Hongsheng Zhou, Yi Yuhan Wang

Article

29 September 2021 | Open Access

Multifunctional Aerogel Fiber Radiative Cooling Fabric for Outdoor Personal Thermal Management

Radiative cooling fabrics can reduce the temperature of the human body. However, they are bulky, poorly breathable, and their porous structure weakens their mechanical and cooling performance. Here, the authors report a multifunctional aerogel fiber radiative cooling fabric that is thin, breathable, and mechanically robust.

Linan Feng, Hongxing Wang & Peihe Zhang

Article

29 September 2021 | Open Access

Emergent charge crystallization and frustration in a particle-ice spin ice

Artificial spin ice is an artificial system for studying geometrically frustrated states. Here, the authors report the observation of emergent charge crystallization and frustration in a particle-ice spin ice, where magnetic and charge degrees of freedom are both constrained on an ice geometry.

Ronnel Rafflin, Matthew Tarzia & Pierre Thuro

Article

29 September 2021 | Open Access

Puzzling isotonic solid even staggering of charge could in deformed rare-earth metal

Exploring the quasi-symmetry-access isotonic nuclear charge probes insight into the dependence of nuclear deformation on the number of protons and neutrons. Here, the authors report the discovery of the isotonic shift in the charge radii of neutron-deficient rare-earth nuclei around the neutron number $N = 76$. Via this, resolving the anomalous δ_{2n} charge radius and opening a path toward understanding the nuclear deformation.

Y. Yang, X. Yang & W. Nazarewicz

Article

29 September 2021 | Open Access

The effects of boryl-methine chain diffusion on the non-linear mechanics of amino-cryolithe polymers

Understanding polymer mechanics is crucial for the development of high-performance materials. Here, amino-cryolithe polymers are found linked to the deformability of such polymers but their mechanical properties are not well understood. Here, the authors report the effects of boryl-methine chain diffusion on the non-linear mechanics of amino-cryolithe polymers.

Rosa Diaz Velazquez, Eduardo Peinado & Thomas Thuro-Alexander

Article

29 September 2021 | Open Access

SpaCy links spatial tissue patterns to clinical outcomes using multiplexity graph neural networks

SpaCy uses multiplexity graph neural networks to link spatial tissue patterns to clinical outcomes in cancer and other diseases, enabling personalized prognosis and treatment selection.

Ahmet Sureyya Rifaioglu, Eglen Ershow Ali & Ada Sanin Rodriguez

Article

29 September 2021 | Open Access

Lateral dual-boron site-site modulation of twin-defective noble-metal free high-entropy alloy electrocatalyst for Li–O2 batteries

Lithium-oxygen batteries (LOBs) are promising energy storage devices due to their high theoretical energy density. However, the sluggish oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) kinetics and severe side reactions hinder their practical application. Here, the authors report a lateral dual-boron site-site modulation of twin-defective noble-metal free high-entropy alloy electrocatalyst for Li–O2 batteries.

Jin Li, Yu Wang, Yuanyuan Li, Yuanyuan Ma, Yanbin Li, Yongfeng Hu, Yongchao Tang, Jiantao Li, Yaping Du & Shichun Mu

Article

29 September 2021 | Open Access

Emergent memory in cell-like active systems

Living cells can contain complex, non-Markovian memory effects influencing their motility and response to environmental cues. Here, the authors introduce a minimal theoretical framework to describe memory-driven dynamics in active systems, and show how it can be used to infer memory properties from experimental trajectories, and to engineer environmental memory spontaneously arises.

M. Caraglio & A. Gambassi

Article

29 September 2021 | Open Access

Layered double hydroxide stabilized polyvinyl alcohol electrolyte for flexible quasi-solid-state supercapacitors

Achieving both high energy density and power density in flexible supercapacitors is challenging. Here, the authors report a layered double hydroxide stabilized polyvinyl alcohol electrolyte for flexible quasi-solid-state supercapacitors with high energy density and power density.

Yuxin Zhang, Yuanyuan Shang, Xiaoli Peng, Hongzhi Cui, Xinzhong Wang & Jian Liu

Article

29 September 2021 | Open Access

Pathway to optical cycle of dynamic photonic cavities via electron temperatures in transparent conducting oxides

Controlling light with materials is fundamental to photonics and is often limited by the inertia of electrons. Here, authors show that electron-assisted heating in transparent conducting oxides allows sub-femtosecond optical switching and pave the way to ultrafast optical cycle of dynamic photonic cavities.

Jun Xu, Yang Jiahong, Mohammad Al-Mohammad, Nader Engheta

Article

29 September 2021 | Open Access

Self-supervised photon thermometry enhancing fluorescence lifetime sensor diagnosis and temperature monitoring

Fluorescence lifetime sensing is a powerful technique for temperature measurements. Here, the authors develop a flexible self-calibration lens under natural green luminescence aggregates for temperature monitoring and fluorescence lifetime sensor diagnosis in real-time.

Wenjing Zhu, Xiaoyuan Qian, Xin Ke & Yong

Article

29 September 2021 | Open Access

Multinuclear approach of metal–chiral covalent organic framework for switching resistant permanent nonlinear holographies

Achieving polarization response of metal-organic frameworks and catalytic module in covalent organic frameworks is challenging. Here, the authors report a metal–chiral covalent organic framework with strong circularly polarized luminescence and nonlinear optical response, which can be used for switching resistant permanent multifunctions in logically encoded circuits with encryption, compatibility, and advancement.

Zhi-Yuan Gao, Fei Wang, Kaiyu Wang

Article

29 September 2021 | Open Access

Tunable nanofluidic ion gating via in-situ ion precipitation-dissolution

Nanofluidic ion gating is crucial for achieving artificial ionotronic technologies that can selectively regulate ion transport. However, current ion gating strategies suffer from poor tunability and low switching ratio. Here, the authors develop a tunable and functionally. This study introduces an in-situ ion precipitation-dissolution gating mechanism for ion transport and explores ionic-electronic coupling for ionotronic logic.

Fangyuan Ji, Dongjin Qian & Yanyong Wei

Perspective

29 September 2021 | Open Access

Multistatic reactivity of weak-field clusters at ambient temperatures

Magnetic clusters decrease in reactivity with high spin centers in particular when studied near room temperature. Here, the authors report the multistatic reactivity of weak-field clusters at 25 °C, which stems from an unusual dynamic favoring the effects of even the very weakest fields.

Tilla Scott Gale & Justin L. Wuning

Article

29 September 2021 | Open Access

Robotic co-design of flow-optic distributed acoustic sensing and coherent communication

Integrating sensing and communication is crucial for future fully connected and intelligent networks. Here, authors develop a methodology to design robotic co-design of flow-optic distributed acoustic sensing and coherent communication, which can be used for underwater sensing and communication and other sensing.

Zihao Yu, Yuxuan Zhang & Ying Jiang

Article

29 September 2021 | Open Access

Topological memory of nonreciprocal scattering singularities

Wave systems with memory can exhibit topological effects that depend on their history. Here, the authors report the observation of topological memory of nonreciprocal scattering singularities in a microwave waveguide system and demonstrate a protocol for preserving them over long distances.

Yonggi Shi, Zhe Zhang & Kenneth Thorpe

Article

29 September 2021 | Open Access

High-sensitivity deep-shortwave infrared organic photodetectors established by selenium-incorporated pentacidal molecular semiconductor

Organic photodetectors (OPDs) with a shortwave infrared (SWIR) response have broad application prospects. Here, authors report a selenium-incorporated acceptor with a high specific detectivity exceeding 10^{12} Jones across 300–1900 nm, which enables flexible imaging and optical communication.

Wenchao Zhao, Zhengran He & Chuluo Yang

Article

29 September 2021 | Open Access

Microstrip as programmable temporal kernels enabling photonic AI beyond 100 Gband

Artificial intelligence is driving the development of new and scalable computing functions. Here, authors demonstrate a programmable temporal kernel using a microstrip waveguide, enabling photonic artificial intelligence hardware with ultra-low bit error rate.

Mengxi Tan, Xingyuan Xu & Roberto Morandotti

Article

29 September 2021 | Open Access

Electrical control transmission across electrolyte junctions incorporated by atomically-thin graphene

Here we demonstrate that atomically-thin graphene can control transmission across liquid electrolyte junctions without altering ionic or molecular in situ, enabling communication across electrolyte impermeable membranes.

Yuanyi Wang, Mingming Ma & Ming Ma

Article

29 September 2021 | Open Access

Li$^+$ Shuttle Duo enables safe fast ion transport in solid polymer electrolytes

Solid polymer electrolytes suffer from sluggish Li$^+$ transport. Here, authors develop a shuttling strategy with "polymer-in-salt" solvation through multivalent metallic salt, which enables fast Li$^+$ transport in solid polymer electrolytes and high-voltage, wide-temperature, and fast-charging capacities when LMO cathode.

Yuan Chen, Yaowen Huang & Yu-Guo Guo

Article

29 September 2021 | Open Access

Structural evolution induced strong coupling in CaBa Co4 O7 for oxygen evolution studies low-overpotential electrocatalytic ammonia synthesis

Electrocatalytic nitrate reduction offers a sustainable route for ammonia synthesis but suffers from poor selectivity and activity. Here, authors report a strong coupling between Co and Ca in CaBa Co4 O7 that can boost ammonia selectivity and production rate, and demonstrate a Zn-nitrate battery with high power density and production of NH3 from wastewater.

Yingjie Fan, Weitao Zheng & Yanrong Zhang

Article

29 September 2021 | Open Access

Mechanically amplified, hybrid silicone aerogel for thermal insulation, showing radiative cooling and sustained flame protection

Silicone aerogels are widely studied for its outstanding properties, but limited by poor mechanical flexibility. Here, the authors report a hybrid silicone aerogel with mechanical flexibility, thermal insulation, radiative cooling and sustained flame protection.

Zhihui Wang, Haibing Xie & Wei Yu

Article

29 September 2021 | Open Access

Ultrafast dynamics of nonlocal epsilon-near-zero phonon polaritons in a van der Waals crystal

Here, the authors report the observation of ultrafast dynamics of nonlocal phonon polaritons in a van der Waals crystal. Using time-resolved near-field microscopy, they directly image the nonlocal epsilon-near-zero phonon polaritons in hexagonal boron nitride and demonstrate their ultrafast switching.

Yinming Shao, Alexander J. Sternbach, D. N. Basov & Michael M. Fogler

Article

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Unmasked α-amino acid synthesis enabled by nickel-catalyzed reductive coupling of redox-active carboxylic acid derivatives and C(sp^3)–H functionalization

Reductive coupling of derivatives of amino acids is a highly desirable but in fact challenged transformation. Here, authors report a nickel-catalyzed reductive coupling of redox-active esters of amino acid derivatives and benzylic C–H bonds, enabling the assembly of structurally diverse unnatural α-amino acid derivatives from readily accessible materials and N-(4-Benzoylphenyl)-2a-ergoxy-2-ethyl-2-methylpropanamide.

Yuanyuan Chen & Xiaoli Wang

Article

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Wing-tail coordination balances efficient cruising and maneuvering flight in an avian inspired flapping robot

Birds can balance efficient cruising and maneuvering flight by coordinating their wings and tail. Here, a bird-inspired flapping robot with morphing wings and tail is developed to investigate the wing-tail coordination and its influence on flight speed envelope and maneuverability.

Haitao Yan, Weihua Zhang & Xiaoping Ma

Article

29 September 2021 | Open Access

Reversible photoisotropy of quantum dots achieves high-performance electroluminescence

Quantum dots (QDs) are promising materials for optoelectronic devices, but it is challenging to achieve developed reversible, wavelength-controlled ligand modification in photocouple heterojunction. Efficient photoisotropy of QDs and their electroluminescence and thermal.

Yuhang Liu, Weiran Cao & Xiaoyang Zhang

Article

29 September 2021 | Open Access

Jamming-controlled viscoelasticity in metal insulator switching

Phase transitions accompanied by a change in viscoelastic behaviour can alter the mechanical properties of materials. Here, the authors report a jamming-controlled viscoelasticity in metal insulator switching in VO_2 and use the potentially tuned ice jamming.

Hyunki Ji Kwon, Seung Phoungthonlee & Ching-Tai Nguyen

Article

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Approaching Landauer's limit in a single superconducting vortex memory bit

The authors investigate the energy required to manipulate a memory bit encoded in the position of a superconducting vortex confined in a double-well potential. They experimentally demonstrate the operation of the memory bit and its manipulation within an error rate of 10^{-6}.

Nella Poletto, Kai Nesse & Yosefeen Anderberg

Article

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Fast in-vivo multiplexed full-color and large field-of-view computational holographic displays

Holographic displays can provide high-resolution 3D images but conventional displays with visual depth cues require a trade-off between field of view and frame rate. Here, the authors report a computational holographic display that can provide full-color, large field-of-view, and high-speed images with depth perception.

Yongchang Wang, Yang Yang & Yongtian Wang

Article

29 September 2021 | Open Access

Efficient hydrogen peroxide synthesis from oxygen via Au- and Pt-catalyzed SnOx under moderate temperature gradient

Hydrogen peroxide is a green oxidant with high energy density. Here, authors report a Au- and Pt-catalyzed SnOx under moderate temperature gradient, which can achieve high hydrogen peroxide production rate and selectivity.

Yuqiao Liu, Xiaoyu Zhang & Yanrong Zhang

Article

29 September 2021 | Open Access

Colossal magnetic tunability of excitons in 2D van der Waals magnetic semiconductor $CrSBr$

Finding 2D materials with large magnetic tunability of optical properties is challenging. Here, the authors report the observation of colossal magnetic tunability of excitons in the 2D van der Waals antiferromagnetic semiconductor CrSBr.

Andrew Ziyuan Jiang, Wei Zhu & Ting Mei

Article

29 September 2021 | Open Access

Multimodal hydrogel modulation of extracellular vesicle cargo to arrest post-traumatic osteoarthritis in murine models

Extracellular vesicles (EVs) are promising therapeutics for osteoarthritis (OA), but their clinical translation is limited by low production yields. Here, the authors report a hydrogel system that enhances EV production in vitro and in vivo, in a murine cartilage injury model, paving the way for translation of EV therapies to treat OA.

Yuxiang Zhang, Wei Zhu & Ting Mei

Article

29 September 2021 | Open Access

Unveiling full mechanistic picture of Mo-catalyzed nitrogen fixation driven by SmI_2–H$_2$O system

Molecular sieve catalysts have attracted a lot of attention in heterogeneous catalysis. Here, the authors develop a microporous Mo-catalyzed nitrogen fixation system driven by SmI_2–H$_2$O system, which can be used for the preparation of ammonia and theoretical evidence for the proposed catalytic activity.

Yuan Chen, Yaowen Huang & Yu-Guo Guo

Article

29 September 2021 | Open Access

Record-track durability in industrial solid-oxide steam electrolysis through operational control

Solid oxide electrolysis cells are dependable and viable devices with excellent efficiencies but limited durability. Here, the authors report a record-track durability of 1,000 hours in industrial solid oxide steam electrolysis cells with good hydrogen production.

Andreas Nenning, Christian Gspan & Christoph Hochenauer

Article

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Surface-displayed biofilament enhances neuroprotection and anti-tumor activity of a glutathione-mimicking Ir targeting NPCE1 expressing cancer-associated fibroblasts

Cancer-associated fibroblasts are a major tumor-supporting factor for drug delivery in tumor cells. Here, the authors report a glutathione-mimicking Ir targeting NPCE1 expressing cancer-associated fibroblasts for delivery of cytotoxic nanodrug to enhance the tumor-targeting and tumor-suppressive activity.

Ying Yu, Min Zhang & Peiyun Wang

Article

29 September 2021 | Open Access

Shield cache cluster in DNA topology and nuclease interactions

Nucleases are enzymes that cleave DNA topology-sensitive interactions to lead into DNA damage. Here, the authors report a shield cache cluster in DNA topology and nuclease interactions.

Jingyi Wang, Yuanyuan Li, Yuanyuan Ma, Yanbin Li, Yongfeng Hu, Yongchao Tang, Jiantao Li, Yaping Du & Shichun Mu

Article

29 September 2021 | Open Access

Biocompatible ultrasonic gate/signal sensor for self-powered neurological monitoring

Here, the authors report a biocompatible, ultrasonic transistor of self-powered neurological sensors. Here, the authors develop a biocompatible nanorange with tailored hydrogen-bonded networks, exhibiting ultrasonic gating and signal sensing for self-powered neurological monitoring.

Wu Shi, Xiaojie Liu & Xinxin Li

Article

29 September 2021 | Open Access

Sulfite and isoaspbes pulvi/ziel alcohol-gels via reversible dehydration and salting out

Here, the authors report a reversible dehydration and salting out process for sulfite and isoaspbes pulvi/ziel alcohol-gels via reversible dehydration and salting out.

Mohamed Elsayed, Sarang Zhang & Yi Hu Li

Article

29 September 2021 | Open Access

The atmospheric analogues of dicoumochrome and isomeric diazirine

Fluxes of polycyclic aromatic hydrocarbons have been used as powerful reagents in synthetic chemistry, but their reactivity is poorly understood. Here, the authors report the synthesis of the atmospheric analogues of dicoumochrome and isomeric diazirine, and their reactivity with nucleophiles and electrophiles.

Linda Yang, Tony Sun & Hongying Zeng

Article

29 September 2021 | Open Access

Cyanosilike acid acetable production of cellulose nanofibrils via highly efficient oxalic-acetic acid system to deep eutectic solvent

Cellulose nanofibrils (CNFs) are promising materials for various applications. Here, the authors report a highly efficient oxalic-acetic acid system to deep eutectic solvent for the production of CNFs.

Xiaoning Wang, Jili Zhang & Zhiguo Wang

Article

29 September 2021 | Open Access

Iodide-bridged interfacial hydrogen bonds enable ampere-level electroreduction of deuterated acetic acid

Electrochemical reduction of deuterated acetic acid (DAA) is a promising, sustainable deuterium source. Here, the authors report a high-performance electrocatalytic system for the reduction of DAA to deuterated ethanol with ampere-level current density and high deuterium incorporation.

Yanan Li, Yan Yu & Bin Zhang

Article

29 September 2021 | Open Access

Berry curvature dipole generation and nonreciprocal spin photocurrents in ferroelectric/ferromagnetic heterostructures

Berry curvature dipole (BCD) in nonmagnetic systems has been proposed to induce nonlinear Hall effect. Here, the authors report the observation of BCD in ferroelectric/ferromagnetic heterostructures, where BCD and circular photogalvanic effect generates a nonreciprocal photocurrent beyond the nonlinear Hall effect, which can be used to detect the magnetization direction of the ferromagnetic layer.

Qiong Ma, Yuan Cao & Pablo Jarillo-Herrero

Article

29 September 2021 | Open Access

Solid vapor synthesis of dynamic crystalline one-dimensional supramolecular polymers from amorphous macrocycles

Dynamic crystalline one-dimensional supramolecular polymers (1DSPs) are difficult to synthesize because they have to overcome both the fast monomer self-assembly and the slow monomer exchange. Here, the authors report a solid vapor synthesis of dynamic crystalline 1DSPs from amorphous macrocycles.

Chen Yang, Zhe Cao & Bo-Wang Sun

Nature Communications (Nat Commun) ISSN 2041-1723 (online)